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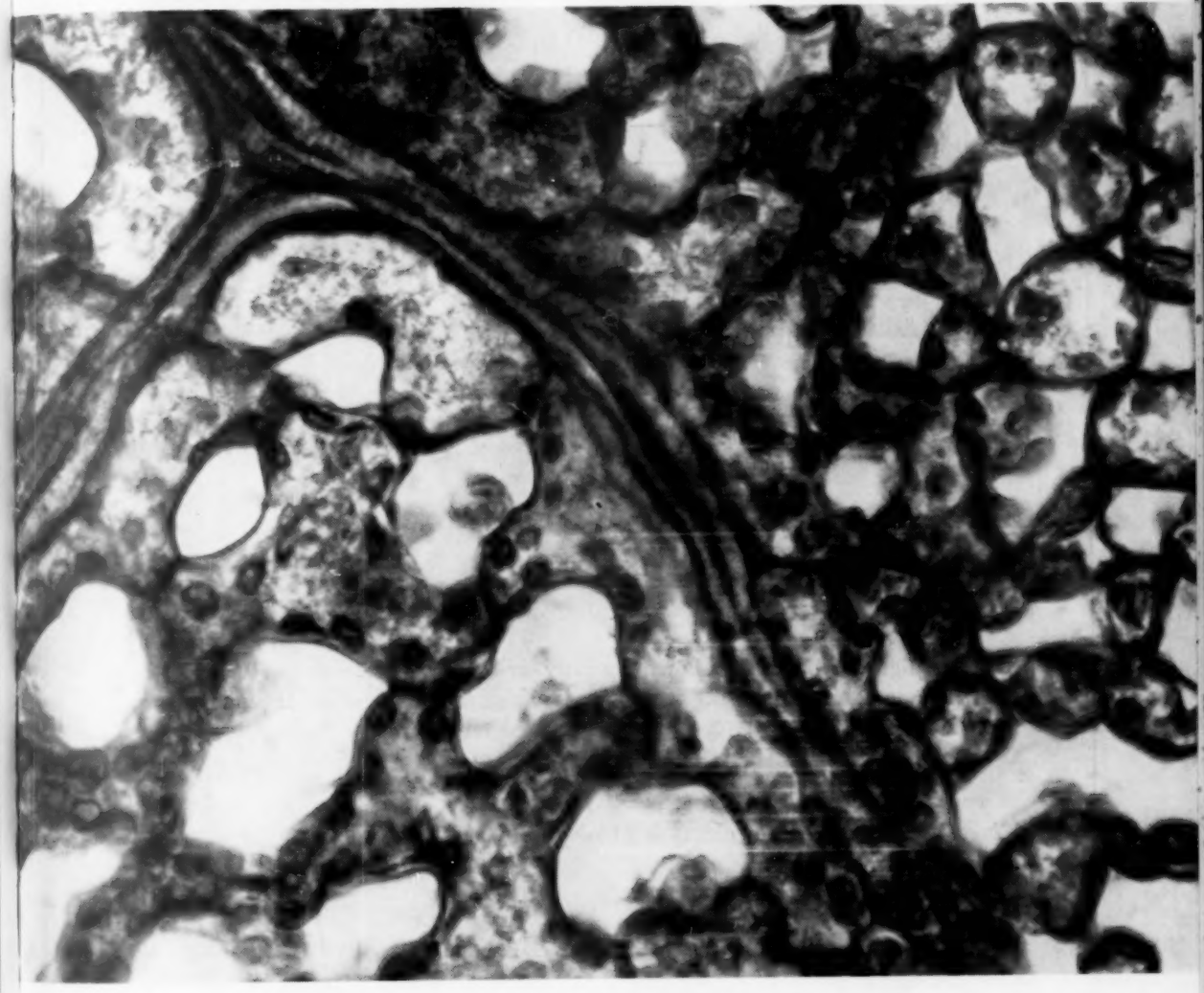

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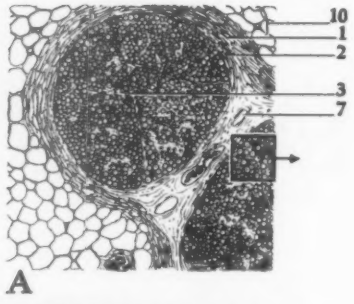

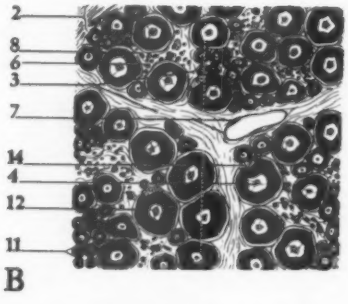

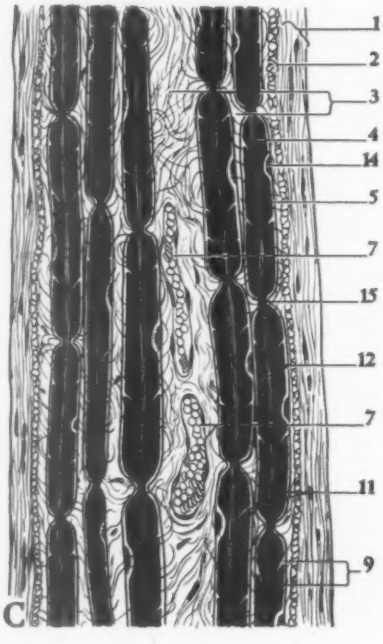

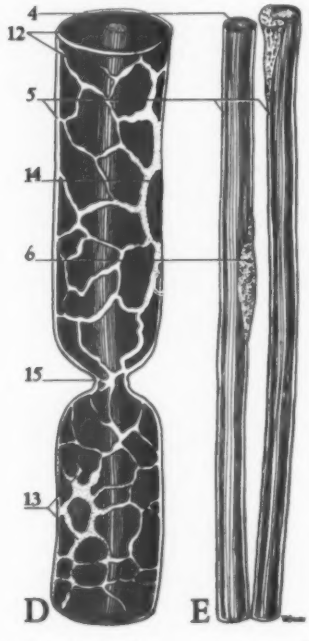

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TABLE OF CONTENTS

A Changing Emphasis in Introducing Photosynthesis . . 39
Herman S. Forest

The Use of Bacteria in High School Biology 41
Roy M. Johnson

Biology for the Blind 42
James R. Dawson

Let's Reduce the Work 44
Sister Mary Thomasine Patterson

Indian Plants 45
Richard Headstrom

Report of the AAAS Committee on the Teaching of Science and Mathematics 46
Brother G. Nicholas, F.S.C.

Selected Conservation Films 48
Emery L. Will

The Usefulness of Fossils 51
Richard P. Aulie

Vacation with a Profit 52

A-V News 53
Emery L. Will

Biology in the News 54
Brother H. Charles, F.S.C.

Cover Photograph

A photomicrograph of a paradermal section (cut parallel to the epidermis) of the leaf *Cornus* sp., showing the lower palisade (to the right), a forked, minor vein and the spongy mesophyll (left).

THE AMERICAN BIOLOGY TEACHER

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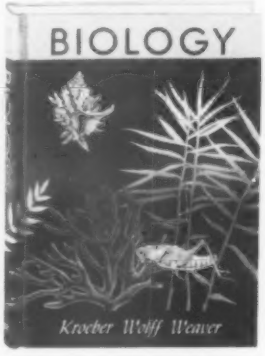

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A Changing Emphasis in Introducing Photosynthesis

HERMAN S. FOREST

Department of Plant Sciences, The University of Oklahoma

One result of recent discoveries is to cause concern to the teacher of general botany and biology. Just what part of new material can be incorporated, and what of the old material should be omitted? Reorganization of the photosynthesis presentation, rather than alteration of the old, is suggested.

Just what is the principle most worth teaching in the study of photosynthesis?

GREEN PLANTS ARE ABLE TO CONVERT LIGHT ENERGY INTO CHEMICAL ENERGY AND TO ACCUMULATE THIS ENERGY.

1. Except for light, very little of the energy received by the earth can be stored conveniently, hence the green plant is the primary producer of stored energy: the foods of organisms and the fuels of power-using machines.
2. The light energy together with other agencies splits water into hydrogen and quickly freed oxygen. The hydrogen becomes part of higher energy carbon compounds, foods and fuels. The energy is released when the carbon compounds are oxidized, and water is reformed.

This principle is what might be called the "Energy Approach."

The energy approach has at least two grounds to commend it. While there are difficulties in defining photosynthesis in terms of a single material transformation, or even a reasonable number of transformations, the energy transformation is clear-cut, in outline, at least. The emphasis on energy is not only satisfying pedagogically, but can be used to focus attention on the state of current human problems in energy or power.

Perhaps the most fundamental criterion of standard-of-living is the amount of energy used per individual not only as food but as power. Clothing, housing, machines demand power. The energy of food and over ninety-five percent of the power that runs machines are accumulated during photosynthesis! In a time of unprecedented population increases and widespread demand for rises in standard-of-living, the question of the source of this food and power is a critical one.

The traditional treatment of the chemical changes involved in photosynthesis is, "Carbon dioxide reacts with water in the presence of light and chlorophyll to form glucose and free oxygen. Actually, starch is commonly accumulated, sucrose too, and these appear to be "direct" products of photosynthesis in the same sense as the stable simple sugars. Hence the general term "carbohydrate" might well be used to represent the energy storing products. Products deserving special mention include not only starch but cellulose, which is derived from the simpler carbohydrates. These two substances are apparently the most abundant carbon compounds found in plants.

Indeed, there seems to be some synthesis of fats, proteins, and other higher energy substances directly from photosynthetic intermediates, but this activity need not be considered a part of the usual photosynthesis concept.

From the energy viewpoint, carbohydrates and other higher energy compounds are energy pools; pools of starch, cellulose, and sugar are quite large and common, and occasionally there are fat pools.

The problem of identifying intermediate steps had to await some recently available physical and chemical tools. Following the discovery that oxygen was produced by isolated chloroplasts in light, the use of the heavy oxygen isotope enabled demonstration that the oxygen came from water.

$$CO_2 + 2H_2O^{18} \ldots . (CH_2O) + O_2^{18} + H_2O$$

The effect of the light is to split water. In the process light energy is transformed to chemical energy, simply:

$$2H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} (4H) + O_2$$

Accumulation of the energy, however, is accomplished in other reactions. There is the

formation of carbon-phosphorous compounds (fixation of carbon). These intermediates are higher in energy value than CO_2. Understanding the role of these compounds in living cells has been one of the basic concepts gained in the last twenty-five years. Briefly, it is thought that part of the energy which is introduced into the plant in the splitting of water is transferred to the phosphorus compound ATP (adenosine triphosphate). The additional energy is then transferred from ATP to carbon compounds, resulting in the production and perhaps accumulation of a higher energy carbon compound, usually a carbohydrate.

It is apparent that a single chemical equation is inadequate if even a minimal outline of the process is to be represented. Such a minimal representation according to some current concepts might be provided in a diagram such as the following. No attempt is made here to balance the transformations chemically, and the conventional "R" is used to represent the residue or remainder or some of the involved molecules.

STEPS IN PHOTOSYNTHESIS *

$2\,H_2O \longrightarrow$ little known bridges of carbon compounds $\xrightarrow{CO_2}$ $R(HCO_2)$ phosphoglyceric acid

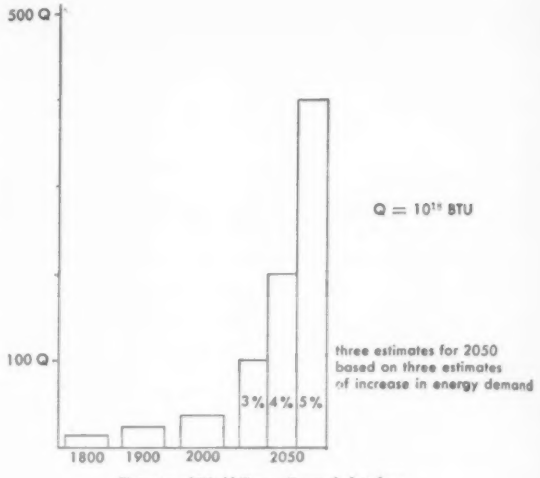
$R(HCO_2) + 2(H) \longrightarrow R(CH_2O) + H_2O$ with phosphorous

$R(CH_2O) + 2(H) \longrightarrow (CH_2O)$ carbohydrate without phosphorous

3-carbon phosphate

*The scheme follows closely the suggestions of Dr. Robert Emerson, but the author accepts responsibility for its defects.

From the energy viewpoint there is no need to designate any one higher energy compound as the end product of photosynthesis. Many substances may be synthesized in independent sequences from the intermediate carbon compounds of one from the other. All of these carbon compounds may be thought of as energy reservoirs or pools, and their transformations involve the flow of energy from one to the other. To follow the analogy further, we may think of a continuous stream with numerous storage pools and frequent outlets, and even with water wheels operating pumps which lift certain channels over high spots. Various stream patterns develop, differing, too, in the size of their pools (in different



Estimates of World Energy Demand, data from Putnam, P. C., *Energy in the Future*

Fig. 1 World Energy Demand

plants different carbohydrates accumulate), but the origins of the streams and the outlet are of a similar pattern in all.

View the accumulated organic compounds as storage pools which may be used in respiration by organisms. This flow from the pools enables the activity of life. The energy is transferred to motion, organization of cell materials, movement of molecules or ions, and synthesis of more complex compounds.

Biological aspects of life are no longer the principal drainers of the pools: machines have required more energy in the twentieth century than the human race with its domestic beasts expended during their entire previous history. From the pools of energy come the materials from which we seek comfort and joy: cloth, wood, coal, green grass, and flowers. From the pools come the power to run our aeroplanes, heat our houses, manufacture our radios, shoot our guns.

No pool, needless to say, is bottomless. Energy pools (coal, oil, timber) which were accumulated over centuries have been drained in a few years, and serious attention might well be directed to the primary producer of practically all of our present supply, the green plant. Especially from the energy approach, photosynthesis can be appreciated as the process which supplies life and productivity.

The Use of Bacteria in High School Biology

ROY M. JOHNSON

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I. Collection and Preservation of Cultures

The use of bacteria in teaching biology in high school is often limited by three factors: their potential role as pathogens; the lack of a suitable microscope; and inability to keep cultures readily available. Actually bacteria offer a ready source of living organisms requiring less time, space and care than any animal and many plants. They further lend themselves to many experiments in which a microscope is unnecessary.

Non-pathogenic species of bacteria are readily available from commercial supply houses or from the Bacteriology Department of a nearby University. For the more enterprising teacher a bit of soil will afford a wide variety of species than can be readily adapted to classroom use.

The medium commonly used for growing bacteria is nutrient broth or its solid equivalent, nutrient agar, both available, in dehydrated form, from commercial supply houses. A common pressure cooker will function adequately as a sterilizer. A bacteriological loop is used in transferring cultures. This is a platinum wire with a loop formed at one end, held in a straight metal rod. The glassware needed is test tubes for broth cultures, screw-capped tubes for maintaining cultures and Petri dishes for isolating cultures.

For isolating cultures, Petri dishes are sterilized in an oven at 180°C for 1-2 hours. The nutrient agar is rehydrated, sterilized for thirty minutes in a pressure cooker, poured into the sterile Petri dishes and allowed to harden. The soil is suspended in water and streaked out on the surface of the plate with the bacteriological loop. In 24 to 48 hours at room temperature, colonies of bacteria will appear on the surface; these are picked and transferred to fresh media as a pure culture.

To preserve a given culture, nutrient agar is rehydrated, brought to a boil and poured, in proper amount, into screw-capped tubes. The cap is placed loosely on the tubes and they are sterilized in the pressure cooker. Upon removal the cap is tightened, the tube slanted and the agar allowed to harden in that position. A pure culture is then streaked on the slant and allowed to grow out. Heavy mineral oil is then added to the tube to cover the slant and the culture stored under refrigeration. This procedure will keep a given culture from one to several years. To remove some of the culture the bacterial loop is sterilized in a flame, passed through the oil, the culture picked from the surface and inoculated into fresh, sterile media.

Nutrient broth, rehydrated, and sterilized in cotton-stoppered test-tubes will serve as a convenient media for growing our cultures. It can be made up in advance and stored under refrigeration until needed. Many common bacteria will also remain viable for days or weeks if the broth cultures are stored in the refrigerator.

The above procedures will also work for a wide variety of common molds or fungi. Care should be observed to avoid culturing material contaminated by any form of human excreta; however the media recommended here will not grow pathogens as well as an unwashed glass which contained milk. All cultures should be routinely sterilized in the pressure cooker *before* they are washed out.

II.

Demonstrations of Physiological Principals

Bacteria are frequently utilized in high school biology classes to demonstrate the smallest form of visable life. It is the purpose of this paper to add an additional role; that of demonstrating physiological principals that are otherwise difficult to show.

The equipment is relatively simple. Some test tubes and Petri dishes, commercially available media to which only water is added and a pressure cooker to function as a sterilizer.

To show the effect of enzymes on sugar prepare a 1% solution of table sugar (sucrose) in nutrient broth (Difco). Tube this solution in test tubes, insert a small test tube upside

down into the tube and plug with cotton. Sterilize in the pressure cooker for thirty minutes during which time the small inverted tube will fill with the solution.

Inoculate the tubes with the bacteria and allow to stand at room temperature for 24 hours or until the broth becomes turbid. Save one uninoculated tube as a control.

The presence of acid, indicating the breakdown of the sugar, is demonstrated by adding the indicator brom thymol blue to the tubes. This indicator is yellow in acid, green in neutral, and blue in basic solutions. The presence of gas can be determined by observing the displacement of fluid from the inner tube. Hydrochloric acid and sodium hydroxide can be used to illustrate the function of the indicator.

The utilization of starch can be demonstrated by making a 2% solution of soluble starch in nutrient agar and sterilizing. Petri dishes are sterilized in the oven at a temperature of 170°C for two hours. The sterile media is then poured into the sterile Petri dishes and allowed to harden.

Streak a culture of bacteria across the plate, making several straight lines. After growth has occurred, add a solution of iodine in potassium iodide directly to the media. Where starch is still present the media turns blue; where it has been utilized no color appears.

To demonstrate the enzyme catalase, which breaks down hydrogen peroxide to water and oxygen, add a dilute solution of hydrogen peroxide to some bacteria emulsified in water on a slide. The formation of bubbles indicates the liberation of oxygen.

The breakdown of protein can be shown using commercially prepared nutrient gelatin. This is tubed, sterilized and allowed to solidify; after which the bacteria are introduced. As the gelatin is used up, the media liquefies since the gelling property of gelatin is destroyed along with the compound.

A large number of different bacteria can be used for these tests. *Bacillus subtilis*, commonly found in soil, can be used for the starch and gelatin experiments. *Escherichia coli*, found in all vertebrate feces, produces acid and gas from many sugars including sucrose. Both of the above organisms, along with the majority of bacteria produce the enzyme catalase.

Biology for the Blind

JAMES R. DAWSON
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Southern Oregon College, Ashland, Oregon

During the last school year it was my privilege to teach general biology to classes which included sightless students. It is the purpose of this paper to pass on ideas and suggestions found to be particularly useful in conducting classes of this type.

The most general and frequently recurring problem concerns the routine use of blackboards and charts. These devices may still be used, but the instructor must always be aware of the fact that they cannot replace careful descriptions for his sightless students. Consideration must always be given to make descriptions relate to common objects, and their three-dimensional character must be emphasized. The students who can see the illustrations also derive considerable benefit from descriptions of this type. The instructor will, on occasion, be hard put to find simple forms with which to compare biological objects, but the results achieved with the entire class will more than compensate for the effort required.

The use of modeling clay will illustrate to the blind, in some cases, objects or concepts that might otherwise be somewhat difficult to grasp. It is especially valuable in conveying intracellular rearrangements as in mitosis or meiosis. Before the blind student can manipulate the clay chromosomes properly, some one (the instructor or a helpful student) must outline the cell and the nucleus and locate the tentative equatorial plane with thin clay strips. Once this has been done, the blind student is oriented and can work with the clay chromosomes as the description proceeds, and derive a clear and satisfactory understanding of the process being explained.

Another useful device is the prepared model. Here I do not refer only to commercial models but also to those developed in the classroom to assist in explaining biological processes. It has been my custom to permit students to earn credit by creating replicas of various organs in clay. These models are then used by the students to illustrate short talks on the functions of these

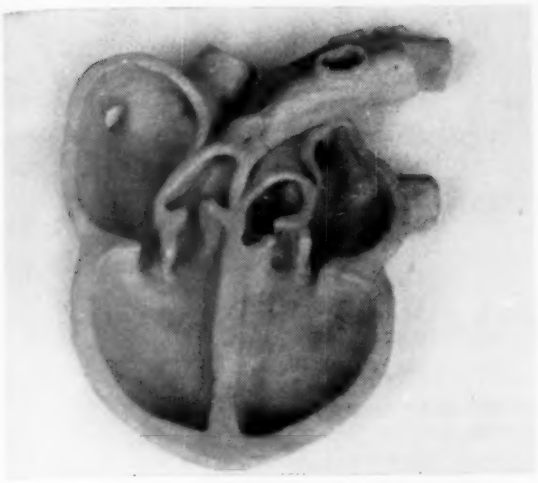


FIGURE 1

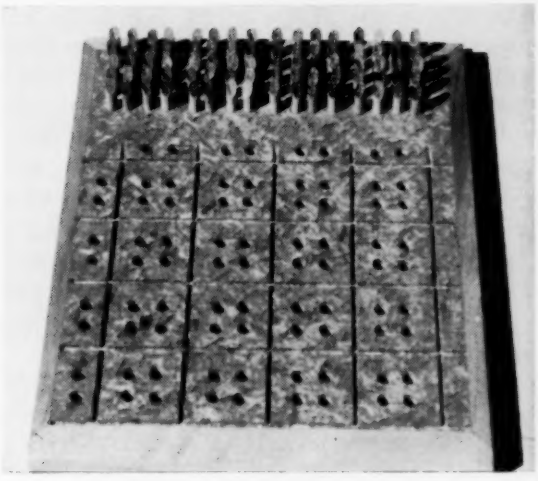


FIGURE 2

organs. These models, built from a functional viewpoint, are most valuable to the blind students. Illustrated above (Fig. 1.) is such a model of the human heart. Granted it does not faithfully follow the actual anatomical details of the heart structure, but it does permit a blind student to come to a clear understanding of the approximate spatial relationships of the chambers, valves, septa and vessels, as well as the course of the blood through the organ.

Commercial models such as plastic manikins may also be used for general information as to the relative positions of the major organs with reference to one another and to the torso as a whole. The weakness in these stems from the fact that models of this sort, although three-dimensional, are basically constructed for the students who can observe them, and the painted lines and multi-colored organs actually mislead those who cannot.

Although the use of the devices and procedures described above is helpful in most cases, occasionally there arise situations in which major concepts cannot be adequately covered without the preparation of aids especially designed for the instruction of the sightless student. One such situation is encountered in attempting to teach the monohybrid and dihybrid crosses in genetics. To permit the sightless student to follow the derivation of the ratios concerned in these problems a special computing board was produced. This board (Fig. 2.) might be called a "tactile" Punnett square. The main body of the board is divided by grooves into sixteen major squares, each containing four ¼" holes. Above, and to the left, of these squares are eight small rectangles, each containing two ¼" holes. These rectangles are so arranged that one is found to the left of each row, and one above each column. At the top of the board are four groups of twenty holes for storing pegs when they are not in use made of ¼" dowling. The top of each peg is cut at an angle of 45 degrees and on the cut surface of each a piece of exposed film has been glued. In each piece of film one of four Braille characters has been punched. The blind student may use the four kinds of pegs to represent the four symbols normally involved in a dihybrid cross problem. Pegs representing the genetic make-up of the two sets of gametes (one set for each F_1 parent) are placed in the small rectangles to the left of and above the main body of the board. By moving the appropriate pegs from the storage area into the proper squares on the board, monohybrid, dihybrid and testcross problems may be solved easily. One of my blind students suggested that a modification of this board, with numerous and regularly spaced holes, might be helpful in graphically solving mathematics problems.

Another problem of some magnitude concerns the testing of the blind students. In general, oral methods are indicated. Although some blind students may express a desire to have their tests administered at home by their readers, mine finally agreed to take them di-

rectly from me in the office. This was accomplished by pointing out to them that they would gain an unfair advantage over the other students, who had to accept the nervous tension of a classroom test. The blind students took the same test as the seeing students, and immediately following them. They showed a surprising ability to form, retain and call up what could be described as a "visual" image. The only concession granted the blind was the repetition of any or all questions on the test at any time. Also, their answers could be changed at any time during the test. In general they did very well, earning grades comparable with those of their seeing classmates.

Let's Reduce the Work

SISTER MARY THOMASINE PATTERSON
Mount Mary College, Milwaukee, Wisconsin.

There is one thing that all of us as teachers are constantly striving to attain. This is true regardless of our field of endeavor, whether it be English, mathematics, history or biology. I refer, of course, to a method of presentation of subject matter that will make the material more meaningful and at the same time interesting and relatively simple. During the past few years in our classes of genetics we have been using the method presented here for working out crosses to determine genotypes and phenotypes. As we have found it quite useful, perhaps you will like it also.

Our first approach to the problem is to determine all possible results of various crosses involving one pair of genes. Obviously, if two homozygous dominants are crossed all offspring will be homozygous dominant. Similarly, we determine results from all possible crosses involving a single pair of genes. They are:

AA × AA ⟶ AA
Aa × AA ⟶ 1/2 AA, 1/2 Aa
Aa × Aa ⟶ 1/2 Aa, 1/4 AA, 1/4 aa
AA × aa ⟶ Aa
Aa × aa ⟶ 1/2 Aa, 1/2 aa
aa × aa ⟶ aa

After a short period of drill with these, using traits such as eye color in humans, color and shape of pod, as well as length of stem of the garden pea, coat color in guinea pigs, etc., these ratios are learned well enough to recognize the results by inspection. Then the class is ready to apply this to crosses involving two or more traits.

In approaching such a problem we ascertain the expected ratio for the first set of genes. For example if the cross were AaBb x AaBb the expected ratio of the trait determined by A would be 1/4 AA, 1/2 Aa, and 1/4 aa. This the student readily understands.

Similarly, we examine the second trait and see that the ratio is the same, as it too, is a monohybrid cross.

Now it is pointed out that 1/4 of *each* of the first genotypes will be homozygous for the dominant B, 1/4 homozygous for the recessive b, and 1/2 heterozygous for the B trait. Therefore, the problem is reduced to working out these combinations. We set it up as shown below.

1/4 AA → 1/4 BB → 1/16 AABB
1/4 AA → 1/2 Bb → 1/8 AABb
1/4 AA → 1/4 bb → 1/16 AAbb
1/2 Aa → 1/4 BB → 1/8 AaBB
1/2 Aa → 1/2 Bb → 1/4 AaBb
1/2 Aa → 1/4 bb → 1/8 Aabb
1/4 aa → 1/4 BB → 1/16 aaBB
1/4 aa → 1/2 Bb → 1/8 aaBb
1/4 aa → 1/4 bb → 1/16 aabb

From these results the genotypes are obtained immediately and there is no necessity of examining the squares and totaling results as one must when using the Punnett Square method of solution.

The problem here used was, of course, the typical dihybrid cross. Any combination of factors can readily be worked out by reducing each to a cross involving a single trait and then obtaining the proper ratio by combining results. Let us illustrate another, more complicated cross.

Problem: Obtain the genotypes from a cross of AaBbCc with aaBbCc

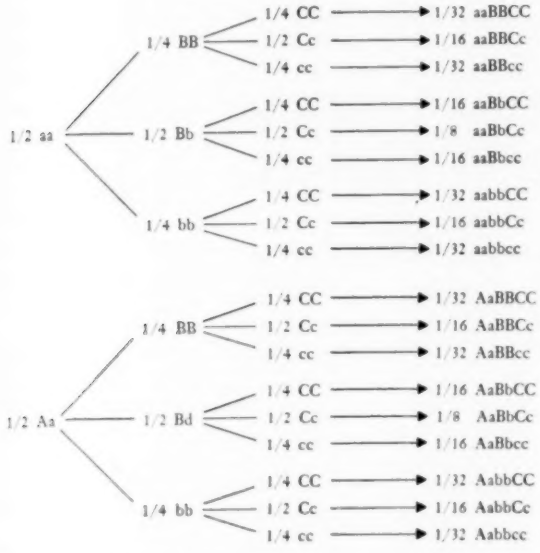
Solution:

1. The A trait results would be: 1/2 Aa and 1/2 aa.

2. The B trait results would be: 1/4 BB, 1/2 Bb, and 1/4 bb.

3. The C trait results would be: 1/4 CC, 1/2 Cc, and 1/4 cc.

Set up the problem:


1/2 aa
1/4 BB
1/2 Bb
1/4 bb
1/4 CC → 1/32 aaBBCC
1/2 Cc → 1/16 aaBBCc
1/4 cc → 1/32 aaBBcc
1/4 CC → 1/16 aaBbCC
1/2 Cc → 1/8 aaBbCc
1/4 cc → 1/16 aaBbcc
1/4 CC → 1/32 aabbCC
1/2 Cc → 1/16 aabbCc
1/4 cc → 1/32 aabbcc
1/2 Aa
1/4 BB
1/2 Bd
1/4 bb
1/4 CC → 1/32 AaBBCC
1/2 Cc → 1/16 AaBBCc
1/4 cc → 1/32 AaBBcc
1/4 CC → 1/16 AaBbCC
1/2 Cc → 1/8 AaBbCc
1/4 cc → 1/16 AaBbcc
1/4 CC → 1/32 AabbCC
1/2 Cc → 1/16 AabbCc
1/4 cc → 1/32 Aabbcc

Again, the results are readily ascertained.

We have found this method to have several advantages over the Punnett Square method. First of all, it shows the student that each trait is independent of the others; secondly, it eliminates the laborious task of setting up the gametes; thirdly, it also eliminates the lengthy process of filling in the squares; and lastly, the results are immediately determined without the necessity of counting the individual squares.

One disadvantage we have encountered is the mental attitude of many—should we say most—students toward fractions. Once this is overcome, however, the method is enthusiastically adopted. Perhaps, you, too, will find it helpful.

HOLIDAY HANDBOOK OF CATS, Holiday, February 1958, pp. 115-120.

This article gives directions as to how to pick and how to live with a pet cat. It includes some wonderful pictures of cats.

Indian Plants

RICHARD HEADSTROM
Canton High School, Canton, Massachusetts

Anyone who has gone "botanizing" has doubtless been impressed with the number of wildflowers that have "Indian" as part of their colloquial names, for example Indian Tobacco, Indian Pipe, Indian Paintbrush to mention a few.

The use of the word 'Indian" by our early settlers when giving names to our native plants was doubtless inspired by the fact that they were used by the American Indian in some manner or else had a fancied resemblance to some article in use by them. The Indian Tobacco, a common plant of our woodland trails, apparently received its name because the Indians dried and smoked the leaves, although how they could enjoy smoking the bitter leaves is something of a mystery. For the same reason the plant, now generally known as the Virginia Waterleaf, enjoyed, for a time at least, the distinction of being called Indian Salad as the leaves were used by them as a salad as well as by our forefathers. Presumably Indian Pipe, Indian Paintbrush and Indian Plume acquired their names because they resembled such objects, although Indian Plume, better known as Oswego Tea, might have more aptly been called Indian Tea since the Indians made a tea from the leaves which is said to have been only a little inferior to true tea.

The Indians made use of a great many plants which to us merely serve to decorate the landscape or are objects for nature study. They ate the root of the Indian Turnip, better known as Jack-in-the-Pulpit, but only after cooking it thoroughly to remove its toxic properties; they made a porridge from the seeds of the Indian Millet and Indian Rice; they roasted the seeds of the Indian Pond Lily and ate them as we eat popcorn; and they cooked the leaves of Indian Lettuce as a pot herb.

They brewed their celebrated Black Drink from the leaves of the Indian Black Drink or Cassena as we now know it and they considered the thick, fleshy leafstalks of the Indian Rhubarb a delicacy, either eating them raw or cooking them as we cook asparagus.

They also relished the root of the Indian Cucumber Root, which resembles the cucumber in taste and smell, and the root of the Indian Breadroot was a staple died of the plains Indians, especially the Sioux. The Northwest Indians ground the root of the Indian Biscuit and made the meal into cakes which became a chief article of trade, becoming known among white men as Biscuit root. Fruits, too, of various plants were eaten, such as Indian Fig or Prickly Pear and Indian Cherry or Carolina Buckthorn. Lewis and Clark speak of the fine quality of Indian Pear and the use the Indians made of it.

The Indian used plants for other purposes, too. They wove the tough fibers of the Indian Hemp into fishnets, mats and baskets and from the Indian Paint or Bloodroot they extracted a fluid of value as war paint. These are only a few examples taken at random. Examine any book on wildflowers and you will find many more.

Report of AAAS Cooperative Committee on the Teaching of Science and Mathematics

BROTHER G. NICHOLAS, F.S.C.
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The Fall meeting of the AAAS Cooperative Committee on the Teaching of Science and Mathematics was held in Washington, D. C. on October 18 and 19. Since one of the most important phases of the committee, the Science Teaching Improvement Program (STIP), is scheduled to terminate its function next year, a report on its accomplishments and an evaluation of these accomplishments was made by John R. Mayor, Director of STIP. In the two years of STIP major emphasis has been placed on (a) working with scientists in colleges and universities toward acceptance by scientists of a responsibility for science teacher education, and (b) the development of good working relationships among scientists and educationists. There are a number of encouraging signs of improvement in the teaching of science and the development of activities which should become effective instruments working toward this improvement. Some of these signs are: A considerable increase in the number of universities and colleges offering special courses in science and mathematics for teachers both in summer and during the academic year; the establishment of states committees on science by Academies of Science, state departments of education and other groups of interested citizens; the appointment of science education committees in colleges and universities including representatives of science and education; the development of closer working relationships among college and secondary-school staffs in science; increased activity on the state and national level in curriculum studies in science. While STIP cannot be given full credit for these encouraging signs, it has contributed along with many other agencies to bringing about these desirable developments.

Letters from high school principals, representatives of state departments of education and university scientists and educators indicate genuine enthusiasm for the Study on the Use of Science Counselors. In addition to improvement in school programs, the Study is credited with being an important factor in the development of fruitful relationships among state department personnel, university scientists and educators, and secondary school teachers and administrators. Information available to date supports a conclusion that this is the kind of activity that universities could profitably continue. In a three-day conference, May 26-28, at Purdue University, the Center coordinators and counselors from the four centers of the Study on the use of Science Counselors reviewed achievements and problems for the coming year. The Study will be continued at the same universities: University of Nebraska, University of Oregon, Pennsylvania State University and the University of Texas. The counselors reported that effective assistance to teachers was being given through sessions on content, library aids, use of texts and outside reading, development of interest in science, use and repair of

equipment, conducting field trips, and caring for individual student differences.

Other contributions of STIP has been the expressed interest of national teacher certification agencies in the participation of scientists and other academic personnel in teacher certification deliberations and studies due to STIP activities; encouragement of a Conference for Junior Academies of Science; continued work with the Educational Advisory Board of the NAS-NRC with special attention being given to the teaching of science by television and films; and support to Midwest State Colleges in strengthening science content of courses for teachers. STIP cannot claim to have made a constructive contribution to the understanding of motivation for the study of science, improving working conditions of teachers, or improving teachers salaries—three parts of the original program.

The Subcommittee on Federal Aid recommended: 1) Funds for a broad extension of merit scholarships to outstanding students, no matter what fields they plan to enter. This was approved by the Cooperative Committee. 2) Financial support for secondary school teachers who are deficient in training in their teaching field, provided that they take work which will lead toward the attainment of standards developed by responsible national organizations conversant with their disciplines. The Committee also approved this plan. 3) Additional tax exemption for college students or for parents of college students to offset tuition fees. This plan was tabled for further study. 4) The designation of a coordinating agency within the framework of an existing organization such as the AAAS to bring together and give encouragement to present and future efforts for the improvement of instruction in the fields of science and mathematics. The Committee approved this proposal after considerable discussion of the role of such an agency and the propriety of such a role for the Federal Government.

The Subcommittee on Acceditation and Teacher Certification reviewed the recommendations made by the Cooperative Committee in 1946 and is considering the effect of new course structures, such as those coming out of NSF summer institutes, on the preparation of science teachers. The subcommittee plans to develop a set of ideal requirements as well as a set of minimum requirements which will take into account what can be realized under existing conditions of teacher shortages. The National Association of Biology Teacher's recommendations on the preparation of biology teachers were presented at the subcommittee meeting, held during the AAAS convention at Indianapolis, December 26-30.

The Subcommittee on the Improvement of College Teaching made two specific suggestions: one for a program of exchange of faculty members between institutions in order to facilitate the introduction of new teaching techniques and concepts and the other for a program of subsidized travel by faculty members to discuss teaching problems and to exchange ideas. A report was made on the activities of the Educational Policies Committee of the Biology Division of NAS-NRC. Among these activities were a Conference on the Teaching of the Biological Sciences which developed recommended college courses of study in taxonomy and parasitism, and an eight-week workshop on the high school biology laboratory. The Educational Policies Committee has also developed a plan for adult education courses in biology. This was turned over to the American Institute of Biological Sciences and the Federation of Societies for Experimental Biology which have approached the Ford Foundation for its financial support. The Cooperative Committee expressed interest in adult education and its desire to see consideration given to the extension of the program to the other sciences.

A committee was appointed to undertake a study of the teaching of science in junior colleges in view of the increasing importance of the junior college in the educational system. Consideration was also given to a proposal that a study be made of science incentive programs—science fairs, science talent searches, and the like. We may be spreading ourselves too thin in these many similar efforts and excessively burdening teachers. There was also considerable discussion to a proposal for the establishment of criteria for designating superior teachers of science and mathematics.

The Spring meeting of the Committee will be in Austin, Texas on April 25 and 26. Members of NABT desiring to have motions considered by the Cooperative Committee should have these sent to the author by March 15.

Selected Conservation Films

EMERY L. WILL

State University Teachers College, Oneonta, N. Y.

This annotated list has been prepared to give teachers and youth leaders a guide to some conservation teaching films of particular value. Most of the entries may be obtained for only the cost of postage. These can be recognized by the appearance of the word "loan." There are fewer rental films of high quality at this time, but some of these few are of exceptional value. All listed films are 16 mm., sound prints. For convenience, the titles have been grouped according to their major theme: general conservation, soil, water, forests, wildlife, interrelationships, and recreational resources. Selections were made on the basis of appropriateness, educational effectiveness, interest and availability. Generally, it is necessary to order films at least one or two months in advance of the planned showing date.

ADDRESSES OF FILM SOURCES:

Audubon: Photo & Film Dept., National Audubon Society, 1130 Fifth Ave., New York 28, N. Y.

Deere: Deere and Company. Loan prints available from film libraries of most land-grant colleges.

deRochemont: Louis deRochemont Associates Film Library, 13 East 37th St., New York 16, N. Y.

Disney: Non-Theatrical Film Division, Walt Disney Productions, 2400 West Alameda Ave., Burbank, Calif. Inquiry will bring you a list of licensed Disney rental agencies in your region.

EBF: Encyclopaedia Britannica Films, Inc., 1125 Central Ave., Wilmette, Ill. Rental prints stocked by all film libraries.

*EBF: Same as above, except that films were produced by the New York Zoological Society and the Conservation Foundation.

Ethyl: Ethyl Corporation, Chrysler Building, 100 Park Ave., New York 17, N. Y. Rental prints handled by film libraries at most land-grant colleges.

FS: Forest Service, U. S. Dept. of Agriculture, Washington 25, D. C. Loan prints handled by regional offices of Forest Service, and also by many land-grant college film libraries and state conservation departments.

F&WS: Fish & Wildlife Service, U. S. Dept. of the Interior, Box 128, College Park, Md.

GE: Film Library Service, General Electric Company, Box 1021, Syracuse 6, N. Y. Inquiry will bring you address of nearest GE film library; prints are also loaned by state health departments and other libraries.

Minn.-Moline: Minneapolis-Moline Co. (Film Library), Minneapolis 1, Minn.

Mo. Cons. Comm.: Missouri Conservation Commission, Jefferson City, Missouri. Apply for loan to your state conservation department.

NFBC: National Film Board of Canada, 630 Fifth Ave., New York 20, N. Y. Rental prints available from many state conservation departments and university film libraries.

Nebraska: University of Nebraska. Loan prints at film libraries of many land-grant colleges and of state offices of Soil Conservation Service.

Phillips: Public Relations Dept., Phillips Petroleum Co., Bartlesville, Okla. Loan prints also in many land-grant colleges.

Pictura: Pictura Films Corporation, 487 Park Ave., New York 22, N. Y. Prints of some titles stocked also at Natl. Audubon Society.

SCS: Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. Loan prints obtained through application to your local district office of the SCS. Many titles also stocked in film libraries at land-grant colleges.

Treasury: U. S. Treasury Department, Washington, D. C. Loan prints available at film library of state commerce departments or of various colleges.

USDA: U. S. Department of Agriculture, Washington 25, D. C. Loan prints available at film libraries of land-grant colleges, usually with slight handling charge.

Wilcox: Roy Wilcox Productions, Inc., Meriden, Conn. Rental prints from Natl. Audubon Society.

A. GENERAL CONSERVATION: (For introduction, overview or summary)

To Conserve Our Heritage. Minn.-Moline; 35 min.; color; 1954; loan. The wealth of natural resources in America, how they have been wasted, and how they must be conserved. Excellent free-loan film. Jr. high and up.

Yours Is the Land. *EBF; 22 min.; color; 1950; rental. Dramatic presentation of the interdependence of soil, water, forests, grassland and animals; their initial development, and man's misuse of them. Sr. high and adult.

B. SOIL RESOURCES; SOIL AND WATER CONSERVATION:

From the Ground Up. SOS; 14 min.; color; 1956; loan. The tools and work of the soil surveyor; importance of soil to world food supply; development of a conservation farm plan. Sr. high and adult.

Keep Your Eye on the Soil. Deere; 18 min.; b&w; 1949; loan. A fine presentation of soil management, utilizing graphic explanatory techniques. Sr. high and adult.

Raindrops and Soil Erosion. SCS; 21 min.; color; 1947; loan. The significant role played by rain-

drops in causing erosion; effects on soils having differing characteristics; somewhat technical. Sr. high and adult.

School Series. SCS; 11 min. each film; b&w; 1948; loan. Four units designed for in-school use, but quite dated pictorially; limited value. Elem. to jr. high.

1. *Topsoil.* Soil as a basic resource; development of topsoil.
2. *Water.* Water as essential to all life, but destructive when uncontrolled.
3. *Erosion.* Causes and effects of erosion; control by conservation farming.
4. *Soil and Water Conservation.* Principles of wise management.

Other Side of the Fence. Phillips; 22 min.; color; 1947; loan. Graphic relation between mineral deficiency in the soil and malnutrition in animals, featuring the work of Dr. William Albrecht (U. of Mo.). Sr. high and adult.

The Golden Secret. SCS; 7 min.; color; 1946; loan. A cartoon fairy story of a land where soil layers are of gold, silver and copper; and how the son of the king's huntsman prevented the golden topsoil from washing away. Primary grades.

The Living Earth Series. *EBF; 11 min. each film; color; 1948; rental. Expanded from of *Yours Is the Land*, for classroom use; very effective. Jr. high and up.

1. *Birth of the Soil.* Natural formation of soil from raw materials; processes of plant decay, growth, and photosynthesis.
2. *This Vital Earth.* Interrelationships of plants and animals, and their organization in natural surroundings.
3. *Arteries of Life.* Water and forests in the chain of life.
4. *Seeds of Destruction.* Dramatic examples of what happens when a link in the chain of life is broken.

The World At Your Feet. NFBC; 22 min.; color; 1954; rental. Excellently photographed account of soil structure and chemistry, of life in the soil, and of significance of soil to mankind. Sr. high and adult.

This Is Our Land. Ethyl; 28 min.; b&w; 1948; loan. Very well done overview of soil, soil nutrients, soil conservation and relation of plants to soil. Sr. high and adult.

C. WATER PROBLEMS AND MANAGEMENT:

Clean Waters. GE; 22 min.; color; 1946; loan. A dramatic portrayal of the role of water in our daily life, the dangers and effects of its pollution, and the structure and operation of sewage treatment plants. Sr. high and adult.

Cloud Over Ohio. Audubon; 33 min.; color; about 1955; loan. A remarkable presentation of water problems and management in Ohio, applicable to most regions of the United States. Produced for Sohio Oil Co., but available nationally only from National Audubon Society. Sr. high and adults.

From the Ridge to the River. SCS; 26 min.; color; 1955; loan. The story of local watershed organization, explaining the correlation of land treatment with work on waterways to provide a lasting watershed protection program of benefit to all people. Jr. high and up.

Lifeblood of the Land. FS; 19 min.; color; 1947; loan. The water cycle; role of water in our lives; erosion control through maintenance of forest cover; destructive force of uncontrolled water. Jr. high and up.

Pipeline to the Clouds. GE; 25 min., color; 1951 loan. This water cycle; water in our lives; securing and safeguarding sources of water; structure and operation of water purification plants. Sr. high and adult.

The Living Water Series. *EBF; 14 min. and 19 min.; color; 1952; rental. The combination of these two films makes a good summary of water resources and management. Jr. high and up.

1. *Nature's Plan.* Importance of water; water cycle; watersheds.
2. *Men's Problem.* Mankind's need for water; storage dams; erosion; pollution; conservation measures.

The River. USDA; 32 min.; b&w; 1939; loan. A gripping documentary of the Mississippi River, showing what man has done to it with damaging effects, and what he has done to rectify past mistakes; summary of TVA development; fine correlation with social studies. Ninth grade and up.

Valley of Still Waters. Nebraska; 20 min.; color; 1952; loan. Watershed treatment for improved farmland and lessened flood damage, as seen in Nebraska's great pilot project undertaken in cooperation with the Soil Conservation Service. Sr. high and adult.

Water for a Nation. SCS; 19 min. b&w; 1951; loan. Water problems typical of six different regions of the United States. Sr. high and adult.

Waters of Coweeta. FS; 20 min.; color; 1953; loan. Documentary on the research at the hydrologic laboratory of the Coweeta experimental forest, located in mountain terrain of North Carolina; relation between forest management and the flow of water in the streams. Sr. high and adult.

D. FOREST RESOURCES AND MANAGEMENT:

A Piece of Wood. FS; 15 min.; color; 1957; loan. The scientific research at the Forest Products Laboratory at Madison, Wisconsin; new and more complete uses of wood, including a wider variety of species, greater use of wastes, and development of laminated arches. Jr. high and up.

Adventures of Junior Raindrop. FS; 8 min.; color; 1948; loan. A fine animated cartoon, interspersed with actual scenes, showing Junior Raindrop's bumpy welcome to hard-packed earth, and of his joining up with other disgruntled raindrops to form torrents, gullies and other flood problems. Primary to jr. high.

Everyman's Empire. FS; 18 min.; color; 1948; loan. Beautifully photographed account of the nature and multiple uses of the National Forests; emphasis upon the right of everyone to enjoy these fine areas. Jr. high and up.

Little Smokey. FS; 12 min.; color; 1953; loan. The famed bear, Smokey, and Hopalong Cassidy join in telling Smokey's crusade to prevent forest fires. Primary grades to adults.

Rainbow Valley. FS; 28 min.; color; 1954; loan. The work of the forest ranger; benefits of forests in the form of grass, recreation, timber, water and wildlife. Sr. high and adult.

The Living Forest Series. *EBF; 11 min. each film; color; 1949; rental. An excellent series for classroom use; also available in a 45 minute forum version. Sr. high and adult.

1. *The Forest Grows*. The forest as an ever-changing plant community, affected by many environmental factors; climax forests; improvement of an overmature forest.
2. *The Forest Produces*. Timber, water and recreation as the forest's great gifts to mankind.
3. *Forest Conservation*. Wise forest management insures a continuing supply of water and timber; protection against enemies of the forest.

Then It Happened. FS; 10 min.; color; 1948; loan. The devastating forest fires in Maine in 1947, with dramatic fire scenes. Fourth grade and up.

E. WILDLIFE RESOURCES AND MANAGEMENT:

A Heritage We Guard. SCS; 30 min.; b&w; 1940; loan. Story of the important role played by wildlife resources in the early development of the United States; the damage to soil and wildlife that accompanied our westward expansion. Fourth grade and up.

Behind the Flyways. F&WS; 30 min.; color; 1951; loan. Waterfowl research and management in the flyways; gathering data needed for preparing hunting regulations, with many behind-the-scenes shots. Sr. high and adult.

Bobwhite Through the Year. Mo. Cons. Comm.; 46 min.; color; loan. Intimately documents the life of a covey of quail throughout all four seasons of the year. One of the finest bird films available. Jr. and sr. high and adult.

Gray Gull the Hunter. EBF; 18 min.; b&w; 1955; rental. The struggle for existence among the bird life of a rocky Swedish island, particularly between the gray gull and the murre. Fourth grade to sr. high.

Realm of the Wild. FS; 27 min.; color; 1945; loan. An excellent wildlife film of game birds and big game in our National Forests, often showing dramatic scenes of the animals in their natural surroundings. Fifth grade and up.

Sunrise Serenades. EBF; 32 min.; color; about 1949; rental. The "booming grounds" and courtship behavior of the prairie chicken, sharp-tailed grouse, and sage grouse; a memorable half-hour of viewing and listening. Sr. high.

The Beaver. EBF; 11 min.; color; 1952; rental. One of the better life history films that emphasizes conservation; includes house construction and the importance of the beaver in conservation and the fur trade. Fourth grade and up.

White Splendor. Pictura; 11 min.; color; 1956; rental. The life story of the snowy egret; how it nearly became extinct because of the popularity of its plumes; what has been done to bring it back from the brink of extinction. One of a series of ten films on wildlife conservation, such as *King of the River* and *Chain of Life*. Fifth grade and up.

Wildlife and the Human Touch. FS; 18 min.; color; 1952; loan. Forest animals in their natural habitats in our National Forests; improvement of these habitats, and management of forests for the benefit of all who use them. Fourth grade and up.

Yours for a Song. Wilcox; 22 min.; color; 1955; rental. With fine closeups of bird life, this film shows how to attract birds to one's garden by providing appropriate food, shelter and water. Fourth grade and up.

F. INTERRELATIONS:

Beaver Valley. Disney; 32 min.; color; 1950; rental. One of the finest of the True-Life Adventure series, this film blends in the life of the beaver with the whole wildlife community of which it is a part. Fourth grade and up.

Nature's Half-Acre. Disney; 32 min.; color; 1951; rental. The complexity of the interdependence of wild creatures and their environment, this time selecting the familiar land right around home. Third grade and up.

Pond Life. EBF; 11 min.; b&w; 1951; rental. The pond as a community of plants and animals in a dynamic balance with each other. Third grade to jr. high.

The Great Adventure. de Rochemont; 75 min.; b&w; 1956; rental. A naturelog produced in Sweden, featuring foxes, otters and other animals; interrelationships are brought out as cycles within cycles in a dramatic, authentic story. The film's length limits its classroom use. Fifth grade and up.

The Web of Life Series. *EBF; 17 min. each film; color; 1950; rental. A superior pair of films ideally suited to effective school use with more advanced groups. Sr. high and adult.

1. *The Strands Grow*. The story of competition and continual change affecting all life, from one-celled forms to the climax forest; all life is bound together in a complicated web; adaptation to environment.
2. *A Strand Breaks*. Creation and destruction within the web of life; consequences of imbalance in nature; need for intelligent management.

G. RECREATIONAL RESOURCES:

America the Beautiful. Treasury; 19 min.; color; 1946; loan. A moving panorama of scenic and power-laden resources in the United States. Fourth grade and up.

Wilderness River Trail. Audubon; 28 min.; color; about 1955; rental. A rubber boat trip down the Yampa and Green River canyons, in the Dinosaur National Monument area; camping, fishing, exploring, rapids-shooting. Sr. high and adult.

Woodland Manners. FS; 19 min.; color; 1952; loan. By using ordinary good manners, all of us can keep our National Forest recreation areas in good condition, and enjoy them to the utmost. Fifth grade and up.

The Usefulness of Fossils

RICHARD P. AULIE
Bloom Township High School, Chicago Heights, Illinois

Anyone who quietly strolls along the sea-shore may observe one of nature's most interesting workshops at his feet.

The native inhabitants include myriad invertebrate creatures. They react with the forces of wind and tide and thus bring about a relentless change in the contour of the land. Farther out, occasional sponges and coral are wrested from their watery home and are cast onto the beach, along with the bones of fish. Gradually, the calcareous remains of these creatures are buried in the sand and enter, thus, the first stage of becoming fossils. Today, one can see evidence of past marine life long distances from the nearest sea-shore.

Slabs of middle-western rock may be seen with the marks of beach ripples impressed on them, along with the petrified remains of their ancient inhabitants. Or, one can find them several thousand feet above sea-level, high in the Rocky Mountains. We know that our extensive limestone and chalk deposits are derived from the shells and skeletons of Marine organisms. Then again, amber from prehistoric trees trapped insects in its sticky substance. During Triassic times, many pine trees in Arizona were covered by volcanic ash. Much of their cellular structure was replaced by silicon dioxide, contributing to later formation of such minerals as quartz, chalcedony, jasper, onyx, and agate.

I once came upon an impressive exhibit of ancient marine life in the remote land of Afghanistan, where I had the privilege of teaching biology some years ago. I accompanied a party traveling by car across the northern, treeless provinces. They make up an arid plain which begins with the broad, talus slopes on the far side of the mighty Hindu Kush Mountain range. The plain is traversed by the historic Oxus River, beyond which lie the steppes of Central Asia. Late one afternoon we stopped to repair a tire. There at my feet were rocks embedded with shells, providing mute testimony that the entire region was once the bottom of the sea.

Usually the hard parts of the organism are preserved, such as the outer shell or the bony skeleton. For example, the chitinous skeletons of arthropods and molluscs are often found whole in shales, limestones, or sandstones. Occasionally, the soft parts may be recorded by impressions on the surrounding rocks, or by petrification which can preserve the microscopic structure of muscle and other tissue. Only rarely, however, are the soft parts preserved entire. This may happen when oil seeps provide antiseptic conditions for prevention of bacterial action. Then we have been told about the mammoths that were found in Siberian soil, perfectly preserved, eighty miles above the Arctic Circle.

Whether it be a fern leaf imprint, the skeleton of a dinosaur, or a broken shell, all are the remains of animals which roamed the past. Thus, organisms are preserved, but only when they are buried in sediment and when they are free from any subsequent denudation. Marine organisms in a fossilized condition are therefore the more plentiful, since they continually collect on the sea-bottom and form part of the ooze.

The possibilities are narrower for land creatures, where animals are preserved only on the bottoms of marshes or lakes, on arid areas where sand gradually raises the surface, and on coastal plains beneath falling forest detritus.

The earth's crust is like a gargantual palimpsest, with its message often obscured by inundations, diastrophic movements, and repeated sedimentations. But for those who can read, the values and interpretations of the geologic record tell us of the ancient past.

In the first place, the "living record of the dead" is of geographic significance, indicating the past distribution of lands and seas. For example, crinoids, sea-urchins, corals, brachiopods, and cephalopods are only a few of the typical marine forms. When they are found as fossils, even inland or at great altitudes, such as the Eocene fossils in the Himalayan region at 20,000 feet or more, they are strong presumptive evidence of an ancient sea. Or again, coral reefs found in Silurian limestones of northern Indiana when cor-

related with other marine fossils help in outlining the extent of an ancient bay or inland sea that once washed the Hoosier state.

Then we may find another usefulness of fossils in helping to build a picture of the climatic conditions in the past. We do this by judging the ecological requirements of their contemporary namesakes. When palms and crocodiles are found in Oligocene rocks of the Dakotas, one may safely infer that winters were considerably more mild than in the present Great Plains area. The rather wide occurence of corals in North America suggests that warm salt water once swirled across much of our rich farmland.

As in the past, present-day living organisms have a distribution which is limited by varying ecological factors. Very often it is said that the distinction between the climates of the tropical and temperate zones was far less pronounced in the past than now. The evidence for this may be taken from the indifferent distribution of Lower Carboniferous flora and fauna in the tropics and in the Arctic Circle region. But this cannot be taken as completely valid, however, since *Lophohelia*, a coral which grows off the Norwegian coast, is no different from tropical coral, though it is washed by the Gulf Stream.

The fossil records also suggest that evolution has taken place in the past. However, gaps in the geologic record and innumerable so-called "missing links" are ancient manifestations of the elemental observation that the major groups of plants and animals are widely separated from each other taxonomically. Whereas series of closely related genera and allied species found in successive local strata afford tangible pictures of the type of evolution that undoubtedly occured in the remote past, it is difficult, nevertheless, to perceive transition forms binding the phyla together.

Lastly, certain index or guide fossils may be used to classify the rocks into definite geologic time. For example, the three-toed horse, *Protohippus*, lived only during the Miocene epoch; the trilobites may be found only in Paleozoic strata; and the ammonite, *Placenticeras intercalare*, may be found in Upper Cretaceous sediments. I found ammonite forms on the surface of the ground, high in Afghanistan's magnificent Hindu Kush mountains.

Vacation with a Profit

To answer the needs of teachers, college students and professors, The Advancement and Placement Institute announces publication of their completely new and expanded 1958 World-Wide SUMMER PLACEMENT DIRECTORY. The Directory is prepared as an aid to those who wish new ideas and ways to earn while they vacation.

The new Directory gives descriptions of the type of work available, salary ranges, names and addresses of employers requesting summer employees. Included are governmental positions, steamship needs, dude ranches, travel tour agencies abroad, work camps, service projects, earning free trips to Europe, national parks, summer camps, theatres and resorts, career trainee opportunities, study awards all over the world and many others. Thousands of opportunities are presented from over *20 foreign countries and all 48 States.*

At the request of many students, a special new section has been added for those students wishing to use their summer in trainee programs for future career opportunites. Positions are available in hundreds of firms in more than forty fields of business, industry, government, science, recreation and education.

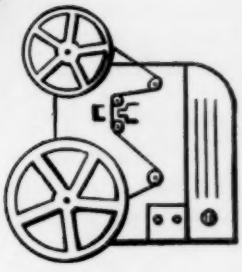
A current up-to-date World-Wide SUMMER PLACEMENT DIRECTORY is published annually by the staff of The Advancement and Placement Institute which has been a non-fee professional advisory and advancement service for the field of education since 1952.

Copies may be examined at many Placement or Deans' Offices, Libraries, School Superintendents' Offices or may be ordered from the Institute at Box 99G, Greenpoint Station, Brooklyn 22, N. Y. for $2.00 a copy.

Will TV Replace the Classroom Teacher?

NABTer Charles E. Packard, Randolph-Macon College, Ashland, Virginia, has an answer for that in *School and Society*, March 30, 1957. "Does not the student gain much of value when he does a project himself—assembles, organizes, handles his own materials?"

A-V NEWS



EMERY L. WILL, Head Science Department
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Following are more descriptions of new classroom films in the biological sciences, which were selected for showing at the NABT meetings in Indianapolis on December 27-28. This year, most selections were made for consideration at the junior-senior high school and college levels. In our opinion, all of them rate very high among the films produced during this past year, and each one has some particular merit. By the way, when you run across audio-visual materials that really suit your needs, why not write an approving note to the producers, so they will know how you react to their products? We'd like to know too.

Basic Nature of Sexual Reproduction. 15 min., sd., color, senior high and college. The fourth in the Continuity of Life series, this one very ably summarizes the major ideas and development of sexual reproductions in plant and animal forms. All the way from gametic fusion in Chlamydomonas to the more specialized types in salamanders and flowering plants, there is excellent organization and remarkable photography. The film concludes with the significance of sexual reproduction in providing for genetic variation through different chromosome combinations. Audio-Visual Center, Indiana University, Bloomington, Ind.

A Career in Bacteriology. 15 min., sd., color, senior high and college. A stimulating presentation of the many opportunities in this field, augmented by an excellent series of scenes showing aseptic techniques, record-keeping and other aspects of bacteriological work. Thus, the film not only presents bacteriology as a challenging, important field, but it also shows approved scientific procedures in a wide variety of modern settings. Audio-Visual Center, Indiana University, Bloomington, Ind.

"Television Film Catalog" is the title of Agriculture Handbook No. 131, recently released from the U. S. Department of Agriculture. It includes brief descriptions of more than 100 USDA films which can be shown on television, 28 units designed for television package programs, and information on the procedures for requesting and showing the films. For $.15, you can obtain a copy from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Making your own audio-visual instructional materials has come to a position of prominence among biology teachers. A series of nine black and white films, ranging from 11 to 20 minutes in length, provides excellent instruction. The titles are: *How to Make Handmade Lantern Slides, Tape Recording for Instruction, Wet Mounting Pictorial Materials, Photographic Slides for Instruction, Lettering Instructional Materials, High Contrast Photography for Instruction, Handmade Materials for Projection, Better Bulletin Boards,* and *Passe Partout Framing.* Audio-Visual Center, Indiana University, Bloomington, Ind.

An inexpensive line of specimen wood collections enables teachers to obtain small study samples of many American species at slight cost. Ryzelite Minerals, Box 445, Golden, Col.

Testing biology classes through the use of projected slides is employed at several high schools and colleges. An analysis of one such project at the University of Colorado is made in an article in the October 1957 issue of *Educational Screen and Audio-Visual Guide.*

The article, "The Use of Slides for Biology Exams," was written by Donald K. Brown and R. E. de Kieffer.

SOME RECENT FILMS AND FILMSTRIPS

Earthworms. 11 min., sd., color, elementary to junior high. Life story of the earthworm; adaptations to underground life; significance of earthworms to other forms of life. Pat Dowling Pictures, 1056 So. Robertson Blvd., Los Angeles 35, Calif.

Adaptations of Plants and Animals. 14 min., sd., color, intermediate grades. Using illustrative forms familiar to child's own environment, the film defines "adaptation," shows what may happen when there is failure to adapt, and demonstrates adaptions to environment, for protection, and for food getting. Coronet Instructional Films, 65 E. So. Water St., Chicago 1, Ill.

American Fishes. (filmstrip) 4 color filmstrips packaged with a copy of the Golden Nature Guide of the same title. Young America Films, Inc., 18 East 41st St., New York 17, N. Y.

Outlines of Natural Science. (filmstrip) 5 color filmstrips, entitled: "Introducing Biology," "Introducing Cells," "Introducing Vertebrates," "Introducing Plants," and "Introducing Invertebrates." Long Filmslide Service, 7505 Fairmount Ave., El Cerrito 8, Calif.

Biology in the News

BROTHER H. CHARLES, F.S.C.
St. Mary's College, Winona, Minnesota

MY LIFE WITH SEVEN SKUNKS, Era Zistel, Sat. Ev. Post, Jan. 11, 1958, pp. 38-39, 57-62.

The friendship of wild animals, even of skunks, can be cultivated if we are interested, cautious and patient. The author learned much about the dispositions of skunks which came to her house for food.

OPERATION WILDLIFE, Corey Ford and James Perkins, Sat. Ev. Post, Jan. 4, 1958, pp. 30, 54-55.

Air fields for our Armed Forces require large areas of land, some of which can and are being used in part as game refuges. Game birds and mammals are provided for, and the personnel of the landing fields as well as the resident population are highly pleased with the results.

REPORT ON "PLAGUE ISLAND", Neil M. Clark, Sat. Ev. Post, Jan. 18, 1958, pp. 43, 84-86.

The sanitary precautions used on Plum Island, one of the newest laboratories of the United States Department of Agriculture for the study of animal diseases, gives a fair idea of what they are doing to prevent the spread of disease.

WHAT YOU MUST KNOW ABOUT THE MEDICINES YOU USE, Ruth and Edward Brecher, Redbook, January 1958, pp. 28-29, 82-83.

What criteria do you and your family use when discarding old medicines? This article gives interesting facts about common and prescription medicines which are in common use. It includes a chart you will want for your bulletin board.

A CHILD MUST FEEL HE BELONGS, Benjamin Spock, M.D., Ladies Home Journal, January 1958, pp. 14-16, 120-121.

You may learn, from contact with psychopaths, how to prevent some of the human disasters which are the result of improper environment.

THE TRUTHS ABOUT JAVELINAS, Bob Housholder, Outdoor Life, January 1958, pp. 21-23, 119-123.

Some interesting information about the desert hog of the Southwest. This animal is also called a peccary. Its actions are unpredictable and frequently thought of as vicious.

HOW TO TALK TO SQUIRRELS, Byron W. Dalrymple, Outdoor Life, January 1958, pp. 44-45, 90-93.

Biology learned in the open and taught by your father is a most enjoyable experience, especially if it increases your joy of hunting. You can learn many ways of the squirrel from reading this article.

CHILDREN AND PETS, L. Emmett Holt, Jr. M.D., Good Housekeeping, February 1958, pp. 30-31, 212.

Are pets dangerous sources of parasites? Should children have pets? This short article may stimulate some very profitable discussion.